

CLAIMS

WE CLAIM:

1. A green reinforced fiber reinforced composite comprising a reinforcement material selected from the group consisting of carbon fiber, carbon fiber tow, ceramic fiber or metal fiber, the reinforcement completely surrounded by a proximal matrix of material selected from the group consisting of graphite or boron, the proximal matrix surrounded by a distal matrix of material selected from the group consisting of hafnium carbide, hafnium diboride, zirconium carbide, silicon carbide, or silicon nitride.
2. A green fiber reinforced composite comprising an outer layer matrix having a longitudinal axis and comprising a first material-laden polymer composition comprising a thermoplastic polymer and at least about 40 volume % of a ceramic or metallic particulate material, an intermediate layer having a longitudinal axis and comprising a second material-laden polymer composition that is different from the first material-laden polymer composition, and a core having a longitudinal axis comprising fiber reinforcement, the fiber reinforcement completely surrounded by the intermediate layer and the intermediate layer completely surrounded by the outer layer matrix.
3. The green fiber reinforced composite of claim 2 wherein the first material-laden polymer composition includes a material selected from the group consisting of hafnium carbide, hafnium diboride, zirconium carbide, silicon carbide, or silicon nitride.

4. The green fiber reinforced composite of claim 2 wherein the second material-laden polymer composition includes a material selected from the group consisting of graphite or boron nitride.

5. A product formed from the method comprising the steps of:

- (a) forming a feed rod having a longitudinal axis and comprising a material-laden polymer composition comprising a thermoplastic polymer and at least about 40 volume % of a ceramic or metallic particulate material;
- (b) forming a hole down the longitudinal axis of the feed rod;
- (c) inserting the start of a continuous spool of ceramic fiber, metal fiber, or carbon fiber through the hole in the feed rod;
- (d) extruding the feed rod and the spool simultaneously to form a continuous filament consisting of the material-laden polymer composition completely surrounding the fiber and said filament having an average diameter that is less than the average diameter of the feed rod; and
- (e) firing the filament to remove the thermoplastic polymer from the filament.

6. A fiber reinforced composite comprising an outer layer matrix having a longitudinal axis and comprising a ceramic or metallic particulate material, an intermediate layer having a longitudinal axis and comprising a second material-laden polymer composition that is different from the ceramic or metallic particulate material of

the outer layer matrix, and a core having a longitudinal axis comprising fiber reinforcement, the fiber reinforcement completely surrounded by the intermediate layer and the intermediate layer completely surrounded by the outer layer matrix.

7. The fiber reinforced composite of claim 6 wherein the ceramic or metallic particulate material includes a material selected from the group consisting of hafnium carbide, hafnium diboride, zirconium carbide, silicon carbide, or silicon nitride.
8. The reinforced composite of claim 6 wherein the intermediate layer includes a material selected from the group consisting of graphite or boron nitride.
9. A method for continuous composite coextrusion comprising:
 - (a) forming a feed rod having a longitudinal axis and comprising a material-laden polymer composition comprising a thermoplastic polymer and at least about 40 volume % of a ceramic or metallic particulate material;
 - (b) forming a hole down the longitudinal axis of the feed rod;
 - (c) inserting the start of a continuous spool of ceramic fiber, metal fiber, or carbon fiber through the hole in the feed rod; and
 - (d) extruding the feed rod and the spool simultaneously to form a continuous filament consisting of the material-laden polymer composition completely surrounding the fiber and said filament having an average diameter that is less than the average

diameter of the feed rod, the filament comprising a fiber reinforced matrix composite;

- (e) firing the filament to remove the thermoplastic polymer from the filament; and
- (f) consolidating the fiber reinforced matrix composite.

10. A product formed from the method of claim 9.

11. A method for continuous composite coextrusion comprising:

- (a) forming a matrix feed rod having a longitudinal axis and comprising a first material-laden polymer composition comprising a thermoplastic polymer and at least about 40 volume % of a ceramic or metallic particulate material;
- (b) forming a hole down the longitudinal axis of the matrix feed rod;
- (c) inserting an interface feed rod having a longitudinal axis through the hole in the matrix feed rod, the interface feed rod comprising a second material-laden polymer composition that is different from the first material-laden polymer composition;
- (d) forming a hole down the longitudinal axis of the interface feed rod;
- (e) inserting the start of a continuous spool of ceramic fiber, metal fiber or carbon fiber through the hole in the interface feed rod;

- (f) extruding the matrix feed rod, interface feed rod and the spool simultaneously to form a continuous filament consisting of the first material-laden polymer composition completely surrounding the second material-laden polymer composition, and the second material-laden composition completely surrounding the fiber, said filament having an average diameter that is less than the average diameter of the matrix feed rod, the filament comprising a fiber reinforced matrix composite;
- g. firing the filament to remove the thermoplastic polymer from the filament, the filament comprising a fiber reinforced matrix composite; and
- h. consolidating the fiber reinforced matrix composite.

12. A product formed from the method of claim 11.